## REMARKS

### I. Status of th Claims

Claims 1-14 are pending in this application, with claims 3 and 4 withdrawn from further consideration by the Examiner.

Without prejudice or disclaimer, claims 1 and 2 have been, as suggested by the Examiner, to correct minor informalities, to modify the Markush language, and for editorial purposes. Also, both claims were amended to recite in their preambles a "method of enhancing adhesion between silica and epoxy resin," and to point out, among other things, that an "epoxy molding compound (EMC)" is formed. Support for these amendments can be found throughout the specification and claims as originally filed. *See, e.g.,* the specification at page 1, first paragraph, page 2, in the Summary of the Invention, at lines 24-28.

Claims 5-14 have been added. Support for new claims 5-14 can be found in the specification and claims as originally filed. *See, e.g.,* the specification at pages 4-6, Detailed Description of the Invention.

In view of the amendments to claims 1 and 2, the title of the invention has been changed to more accurately reflect the claimed invention. Support for this amendment can be found in the specification, *e.g.*, at page 1, first paragraph.

Finally, the specification has been amended, as suggested by the Examiner, to correct minor informalities. Support for these amendments can be found throughout the claims and specification as originally filed, and the previously filed certified copy of the priority application, KR 2001-14393.

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

No new matter has been added by these amendments. As required by 37 C.F.R. § 1.121 (b)(1)(iii) & (c)(1)(ii), Applicants have provided a marked-up version of the amended paragraphs of the specification and the amended claims in the attached Appendix.

## II. Specification

The Examiner has objected to the specification because of minor informalities. In response, Applicants have amended the specification, as discussed above, to correct the informalities. For instance, at page 1, paragraph 3, "200□" now recites --200°C--.[1] *See* attached Appendix.

Thus, Applicants respectfully request that the Examiner withdraw the objection to the specification.

## III. Claim Objections

The Examiner has objected to the claims due to minor informalities. In response, Applicants have amended the claims, as discussed above, in the manner suggested by the Examiner. For instance, in claim 1, "pyrrole 1,2-epoxy-5-hexene" now reads -- pyrrole, 1,2-epoxy-5-hexene --. *See* attached Appendix.

Thus, Applicants respectfully request that the Examiner withdraw the objection to the claims.

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

[1] Applicants note that the originally as-filed application was a copy of an electronic version that did not have all of the symbols, e.g., °C, correctly formatted. A correct version was submitted to the Patent Office on 10/15/01, with the filing of the Response to Missing Parts, which did have the symbols correctly formatted. The symbols were also correctly formatted in the priority application, KR 2001-14393, a copy of which is on file.

## IV. Rejection under 35 U.S.C. § 112, second paragraph

The Examiner has rejected claims 1 and 2 under 35 U.S.C. § 112, second paragraph, as being indefinite. Specifically, the Examiner has asserted that claims 1 and 2 recite improper Markush language.

Applicants respectfully disagree with and traverse the rejection, since section 2173.05(h) of the M.P.E.P. does not require any specific claim language. In order to advance prosecution, however, Applicants have amended claims 1 and 2 in the manner suggested by the Examiner. *See* attached Appendix.

Thus, Applicants respectfully request reconsideration and with withdrawal this rejection.

## V. Rejection under 35 U.S.C. §102(e)

The Examiner has rejected claim 1 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,428,861 to France et al. ("France"). The Examiner alleges, among other things, that France discloses a method of surface modifying particulate matter, such as silica powder, comprising coating the surface of said silica by plasma polymerization of a monomer, wherein the monomer is allylamine or allylalcohol. *See* present Office Action, page 4, para. 7. Further, with regard to the coated silica powders being for EMC, the Examiner asserts that "it is held that a recitation of the intended use of the claimed invention must result in a structural difference . . ., [thus] [i]t is the Examiner's position that there is no structural difference between the surface modified silica of [France] and that of claimed invention since a method of [France] for preparing the surface modified silica is identical to that of claimed invention." *Id.*, pages 4-5. Thus, the Examiner concludes that "the surface modified silica of France is capable of

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

performing the intended use, and consequently it meets the claim." *Id.*, page 5. Applicants respectfully disagree with and traverse the rejection.

As set forth in M.P.E.P. § 2131, "[a] claim is anticipated only if each and every element as set forth in the claim is found . . . The identical invention must be shown in as complete detail as is contained in the . . . claim." (Quoting *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987) (emphasis added).) In the present case, France does not teach all of the elements of the amended claim 1, and thus France does not anticipate the presently claimed invention.

In particular, as amended claim 1, recites EMC in the body of the claim, as a claim element, instead of the preamble. Thus, patentable weight must be given to the recitation of EMC. As France does not teach this element, France fails to anticipate the claimed invention.

Amended claim 1 also recites a "method of enhancing adhesion between silica and epoxy resin," and further points out that the coated silica is combined with the epoxy resin "to form epoxy molding compound (EMC)." Additionally, the body of claim 1 recites, as it did originally, that the enhancement is achieved by "coating the surface of said silica by plasma polymerization," and recites that the coating is effective to achieve the purpose of the invention, *i.e.,* "effective to enhance an adhesive strength between said silica and said epoxy resin."

Applicants respectfully submit that France does not teach or disclose a plasma polymerization coating method that enhances the adhesion between silica and epoxy resin. Rather, at best, France discloses, in the Background of the Invention, that many

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

different types of powders, including silica, *generally* may be useful as raw materials in many different industries, such as rubber. *See* col. 1, lines 50-53. France also discloses that surface characteristics are a very important factor in different industrial applications. *Id.* at lines 48-50. France, however, is completely silent with regard to disclosing a method for *specifically* enhancing the adhesion between silica and epoxy and forming EMC.

Thus, France does not teach each and every element of amended claim 1, and therefore the rejection should be withdrawn.

## VI. Rejection under 35 U.S.C. §103(a)

The Examiner has rejected claim 2 under 35 U.S.C. 103(a) as being unpatentable over France in view of U.S. Patent No. 4,374,717 to Drauglis et al. ("Drauglis"). According to the Examiner, France discloses a plasma polymerization coating method of surface modifying particulate matter, such as silica powder, comprising the steps of the claimed invention. *See* present Office Action, pages 5-6, para. 9. The Examiner uses U.S. Patent No. 4,584,965 to Ogisu, as evidence that steel pipes are conventionally used for injecting monomers. *Id.* The Examiner further asserts that Drauglis demonstrates that operating power levels are merely result-effective variables that can be varied by routine experimentation. *Id.* at page 7. Applicants respectfully disagree with and traverse the rejection.

In order to establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the reference itself or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. M.P.E.P. § 2143. Second, there must be

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

a reasonable expectation of success. *Id.* Third, the prior art reference must teach or suggest all of Applicants' claim limitations. *Id.*

In the present case, the rejection fails at least for the reason that the reference combination to teach or suggest all elements of amended claim 2, which amended analogously to claim 1. *See* attached appendix. Specifically, as discussed above, France does not teach or suggest every element of claim 1, *e.g.*, a "method of enhancing adhesion between silica and epoxy resin" and "combining said coated silica with said epoxy resin to form an epoxy molding compound (EMC)". Moreover, with regard to Ogisu, Applicants have removed the steel pipes element from claim 2, thereby rendering that portion of the rejection moot.

Furthermore, Applicants respectfully point out that neither Drauglis, *nor* Ogisu, even remotely cures the deficiencies of France. Specifically, in contrast to the presently claimed invention, Drauglis teaches the improvement of adhesion brought about by the deposition of acetonitrile polymer layers directly underneath and over a sputtered chromium coating. *See* col. 1, lines 9-12. Ogisu, on the other hand, teaches a plasma apparatus for treating the surfaces of articles, such as plastic resins, with a plasma gas. *See* col. 1, lines 7-9. As such, none of the references, taken individually and in combination, teach or suggest, among other things, a "method of enhancing adhesion between silica and epoxy resin" and "combining said coated silica with said epoxy resin to form an epoxy molding compound (EMC)". *See* amended claim 2.

Thus, Applicants respectfully request that the rejection be withdrawn.

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

## CONCLUSION

In view of the foregoing amendments and remarks, Applicants respectfully request the reconsideration and reexamination of this application, and the timely allowance of the pending claims. Early and favorable indication of the same is earnestly solicited.

Additionally, the Examiner is invited to telephone the Applicants' undersigned representative at (202) 408-4328 if it would be helpful to further expedite the prosecution of this application and, thereby, minimize time and expense.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: April 15, 2003

By: Bryant L. Young
Bryant L. Young
Reg. No. 49,073

#517186

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

## APPENDIX

**Version with markings to show changes made, pursuant to 37 C.F.R. § 1.121 (b)(1)(iii) & (c)(1)(ii)**

**IN THE TITLE:**

The title of the invention has been amended as follows:

~~SURFACE MODIFIED SILICA BY PLASMA POLYMERIZATION PREPARATION METHOD AND APPARATUS THEREOF~~ A METHOD OF ENHANCING ADHESION BETWEEN SILICA AND EPOXY RESIN BY SURFACE MODIFYING SILICA BY PLASMA POLYMERIZATION COATING

**IN THE SPECIFICATION:**

The specification was amended as follows:

**Page 1, lines 22-27:**

Recently, since the semiconductor devices are getting smaller and lighter, the reliability of EMC is more important than ever before. Moreover, the semiconductor devices are heated to above 200°C~~,~~ when they are being mounted, resulting in cracking and thus delamination of EMC due to the CTE mismatch. This phenomenon is even worse if moisture is present, which is usually absorbed into EMC.

**Page 3, lines 26 - page 4, line 3 (i.e., the paragraph bridging pages 3-4):**

To be free from the aforementioned shortcomings, an object of this invention is to provide surface modification method for silica in order to enhance the adhesion to epoxy resin. Silica is coated by plasma polymerization coating with one monomer selected from 1,3-diaminopropane, allylamine, pyrrole, 1,2-epoxy-5-hexene, allylmercaptan and allylalcohol, and subjected to preparation of EMC in order to provide good properties of EMC compare with conventional method. The monomers containing amine functional groups may generate chemical bonds with epoxy resin.

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

**Page 4, lin 23 - page 5, lin 7 (i. ., paragraph bridging pages 4-5:**

This invention is also characterized by a surface modification method of silica for EMC, wherein plasma polymerization coating of silica comprises the steps of:

1) charging of silica with average diameter of 25-35°C into a plasma polymerization reactor 1, followed by vacuuming to 1 x $10^{-3}$ torr;

2) introducing monomer (1,3-diaminopropane, allylamine, pyrrole, 1,2-epoxy-5-hexene, allylmercaptan or allylalcohol) into the reactor via steel pipe; and,

3) rotating the reactor at 1-50 rpm at plasma polymerization conditions: plasma powder (10-40 W), gas pressure (40-50 mtorr) and treatment time (20-40 seconds).

**Page 5, lines 6-7:**

Since the chemical structures of the monomers are different, the plasma polymerization conditions have to be optimized for each monomer.

**Page 6, lines 1-6:**

The EMC for semiconductor package is prepared as follows:

Epoxy resin, hardener and promoter are mixed at 150°C for 3 minutes. Then, plasma polymer coated silica was charged into the resin mixture and stirred for 5 minutes, followed by pouring into silicon rubber mold. The resin mixture was placed in a vacuum oven of 130°C and degassed for 3 minutes, followed by curing in an air-convection oven of 175°C for 4 hours.

**Page 7, lines 26 - page 8, line 5 (paragraph bridging pages 7-8:**

**Examples 9-16 and comparative example 1: Preparation of EMC**

As shown in Table 2, epoxy resin, hardener and promoter were mixed at 150°C for 3 minutes. Then, surface modified silica (Examples 1-8) or unmodified silica were charged into the resin mixture and then pouring into silicon rubber mold. In order to remove any volatiles which may form bubbles and thus lowering flexural strength, the

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

resin mixture was degassed in a vacuum oven of 130□ for 3 minutes and then, cured in an air-convention oven of 175°C⊟ for 4 hours.

**Page 8, beginning at line 6, Table 2:**

Table 2

| Category | | | Example | | | | | | | | Com. Exp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 1 |
| Composition (⊟)(g) | Silica | Exp. ⊟1 | 24 | | | | | | | | |
| | | Exp. ⊟2 | | 24 | | | | | | | |
| | | Exp. ⊟3 | | | 24 | | | | | | |
| | | Exp. ⊟4 | | | | 24 | | | | | |
| | | Exp. ⊟5 | | | | | 24 | | | | |
| | | Exp. ⊟6 | | | | | | 24 | | | |
| | | Exp. ⊟7 | | | | | | | 24 | | |
| | | Exp. ⊟8 | | | | | | | | 24 | |
| | | Silica | | | | | | | | | 24 |
| | Epoxy resin[1)] | | 10.19 | 10.19 | 10.19 | 10.19 | 10.19 | 10.19 | 10.19 | 10.19 | 10.19 |
| | Hardener[2)] | | 5.78 | 5.78 | 5.78 | 5.78 | 5.78 | 5.78 | 5.78 | 5.78 | 5.78 |
| | Promoter[3)] | | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

1) Biphenyl type epoxy

2) Phenol novolac

3) Triphenylphosphine

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

**Pag 9, lines 1-10:**

**Experimental examples 1-7**

The properties of EMC, prepared from Examples (9-14) and Comparative example 1 were evaluated by the test method as follow;

1. The flexural strength of EMC was measured with a sample of 3x10x60 mm by 3-point banding according to ASTM D 790.

2. The CTE of EMC was measured by TMA in a glassy state (lower than Tg) and in a rubbery state (higher than Tg).

3. The water absorption of EMC was evaluated by exposing in a pressure cooker of 121°C⊟, 2 atm and 100% RH for 8, 16, 24 and 32 hours. Three specimens (3x10x60 mm) were evaluated.

**Page 9, beginning at line 12, Table 3:**

Table 3

| Categ-ory | Sample | Flexural strength at room temp (MPa) | Flexural strength at 250□ (MPa) | CTE (μm/m°C⊟) | | Water absorption (wt%) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Glassy region | Rubber region | 8 hr | 16 hr | 24 hr | 32 hr |
| Test 1 | Exp. 9 | 167±3 | 7.5±0.5 | 42 | 128 | 0.50 | 0.66 | 0.70 | 0.70 |
| Test 2 | Exp. 10 | 165±4 | 7.2±0.8 | 39 | 128 | 0.49 | 0.64 | 0.71 | 0.71 |
| Test 3 | Exp. 11 | 157±3 | 5.6±0.7 | 33 | 133 | 0.55 | 0.72 | 0.78 | 0.75 |
| Test 4 | Exp. 12 | 154±3 | 5.7±0.9 | 37 | 135 | 0.49 | 0.69 | 0.77 | 0.76 |
| Test 5 | Exp. 13 | 152±5 | 6.0±0.3 | 38 | 143 | 0.58 | 0.75 | 0.74 | 0.76 |
| Test 6 | Exp. 14 | 148±5 | 5.5±0.4 | 33 | 140 | 0.56 | 0.68 | 0.76 | 0.76 |
| Test 7 | Comp. Exp. 1 | 140±5 | 5.6±0.7 | 35 | 145 | 0.54 | 0.70 | 0.81 | 0.81 |

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

**IN THE CLAIMS:**

Claims 1 and 2 have been amended as follows:

1. (Twice Amended) A method of ~~surface modifying silica for epoxy molding compound~~ enhancing adhesion between silica and epoxy resin, (EMC) comprising:

coating the surface of said silica by plasma polymerization coating with a monomer selected from the group consisting of 1,3-diaminopropane, allylamine, pyrrole, 1,2-epoxy-5-hexene, allylmercaptan, and allylalcohol, wherein said plasma polymerization coating is effective to enhance the adhesive strength between said silica and said epoxy resin,

and combining said coated silica with said epoxy resin to form an epoxy molding compound (EMC).

2. (Twice Amended) A method of enhancing adhesion between silica and epoxy resin by surface modifying silica by plasma polymerization coating comprising the steps of:

1) charging said silica into a plasma polymerization reactor, followed by vacuuming to 1 X $10^{-3}$ torr;

2) introducing a monomer into said reactor ~~via steel pipe~~; and

3) rotating said reactor at from 1 to 50 rpm, with the conditions ~~of having~~ comprising a plasma power of 10 to 40 W, a gas pressure of 40 to 50 mtorr, and a treatment time of 20 to 40 seconds~~;~~,

wherein said silica has an average diameter of 25-35 μm; ~~and~~

~~further wherein~~ said monomer is selected from the group consisting of 1,3-

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

diaminopropane, allylamine, pyrrole 1,2-epoxy-5-hexene, allylmercaptan, and allylalcohol, and said plasma polymerization coating is effective to enhance the adhesive strength between said silica and said epoxy resin; and

4) combining said surface modified silica and said epoxy resin to form an epoxy molding compound (EMC).

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com